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25 YEAR RE-REVIEW

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NAVAL

THE WORK OF GERMAN PERSONNEL ON UNDERWATER WEAPONS IN LENINGRAD

1. SCOPE

It will be seen that although the first scheme to employ Germans in LENINGRAD was grandiose, the the actual work done is not so important and [redacted] little progress was made. 25X1

2. BERLIN 1946

Already in 1946 a Russian Admiral BORCHAGOV was developing a scheme for the exploitation of German scientists. He had Germans working for him in KARLSHORST and ECKNER. Those in KARLSHORST were divided into four sections as follows:

Group I.	Mines and minesweeping	- Leader KOLL.
Group II	Torpedo Control Head	- Leader GLEDE
Group III	Torpedo motor	- Leader von LEWIS
Group IV.	Function not known	- Leader (?) GRAEBNER.

Independent - LUEBCKE.

In ECKNER was only one Group under GUTSCHE.

These divisions and the staffs working in them were arranged by BORCHAGOV and roughly the same divisions were kept in Russia.

3. SESTORETSK 1946

In October 1946 the Germans from both KARLSHORST and ECKNER were sent to SESTORETSK where they were controlled by O.T.B. a branch of the Russian Ministry of Marine. All the Russians in SESTORETSK were naval officers and their Head was Admiral BORCHAGOV. When the Germans arrived in SESTORETSK they found LUEBCKE and HEINZERLING already there; they had flown from MOSCOW.

A week later a group of chemists and engineers arrived from LEUNA under the leadership of Dr. KAUFMANN [redacted] 25X1
It is believed that these people were originally intended to work on propellants.

Next came Hanz MYSLEWETSCHECK, well experienced in combustion tests. He was the only volunteer in the whole group, a general mechanical engineer who studied heat engines in PRAGUE.

Later again Dr. MEECKBACH and the families of MYSLEWETSCHECK and LEWITSCHKA arrived. MEECKBACH while on a visit in 1945 to his Mother in POTSDAM was arrested by the Russians who were under the impression that he was an atom scientist. He was committed to SACHSENHAUSEN concentration camp and to relieve his misery volunteered for work in Russia.

At this time there was also a German prisoner of war who had had experience in short wave work. He had to go back to p.o.w. camp after producing a number of reports.

It was BORCHANOV's plan that the following groups should operate:

(i)	Audio frequencies	-	Leader KOLL
(ii)	Supersonics	-	GLOEDE
(iii)	General acoustics	-	LUEBCKE
(iv)	Control and Driving Gear	-	LAWITSCHKA
(v)	Pistols	-	MARTIN
(vi)	Calculators	-	SIMMEL
(vii)	Chemists	-	Leader KAUFMANN

BORCHANOV was a man of initiative and was also a good psychologist and organiser. It was now that he worked out the plans for the development programme in LOMONOSSOV. He was the right man to establish such an institute but he was re-called in February 1947 and was replaced by Captain first class SERBIN.

4. LOMONOSSOV 1947

In May 1947 the Institute still controlled by O.T.B. was moved to MENSHIKOV Castle in LOMONOSSOV (formerly ORANIENBAUM). The castle had been rehabilitated for this purpose. Captain SERBIN was still in command and after Admiral BORCHANOV appeared incapable. All Russian personnel changes at this time were for the worse.

The MARISHORST and ECKNER Germans were now divided into two departments, and the division of the Institute appeared as follows:

Section I - A Russian Administration Section apparently, no Germans work in it and it is referred to [redacted] always as the 'Secret' Section. It certainly seems to have been responsible for security and administration. 25X1

Section II - The LAWITSCHKA Group. With this Group worked the Russian Engineer TERASSOV, the name of the Russian Chief is not known.

Section III - Consisted of two Groups under the direction of Major GUSKOV, a keen man but not very capable. KOLL's Group was again working on mines and the second Group, GLOEDE's again on Acoustic Torpedo Heads (KOMMANDOGERÄTE).

At this time the Russians were dependent on the Germans for technical guidance and until the 1st May 1948 controls were not very strict.

The work from 1947 to 1948 under O.T.B. consisted of drawing up reports and making measuring apparatus. The Germans were not exploited properly and the general impression was that the arrangement was only temporary. A bunker was planned for combustion tests but O.T.B. did not push this project and as far as is known not even laboratory fuel tests were made.

Wives and dependants were, until 1948, allowed to take jobs, some of them part time. Also as the work of various groups sometimes overlapped, the best men were sometimes called upon to assist in Groups other than their own. During the course of this work with its sub-specialisation, men often came to be

associated with one particular sphere and this is shown in brackets where applicable.

German designers working on the Acoustic Torpedo had the impression that the Russian Ministry of Marine had no intention of developing this weapon as the work was not directed energetically. [redacted] 25X1
[redacted] the Russians were probably frightened off by the German 25X1
estimates of material and equipment required for the project and [redacted] in 25X1
the German opinion development had only reached the stage where counter measures would be most effective. Also when talking amongst themselves the Germans remarked that although LAWITSCHKA's Group continued its work on INGOLIN engines, no further commission of a comparable kind were given to the other two groups and it was concluded that the Russian electrical industry was probably not equal to the task of providing suitable components, since it had been noticed that electrical equipment on the civilian market was of poor quality and badly constructed. They also decided amongst themselves that the Russians would prefer to concentrate on torpedoes having a high speed rather than those equipped with acoustic devices, as they believe that the Russian principle is to have a large number of weapons of a simple design rather than fewer weapons of a more advanced but necessarily more complicated nature.

5. LOMONOSSOV 1947 continued (LAWITSCHKA Group)

Leader - LAWITSCHKA

Combustion Tests - MISLIWETSCHECK

ABERMETH - Designer and probably the most important man in the Group

von LOEWIS - Job not known

SIMMEL - Job not known

KEMPA - Designer

MAGERSTEDT - No particular job

SCHOLZ - Fuel tests (from LEUNA)

DUERING Ursula - Draughtswoman

SLEEL Anita - Draughtswoman

GUTSCHE - Calculations. He was not actually a member of this Group but was a consultant.

LAWITSCHKA Group was mainly concerned with the reconstruction of designs of German torpedoes under the direction of Herr ABERMETH and with the planning of the new laboratory. Plans for the bunker were completed during this period. It is not known what types of torpedo were reported on.

6. 1947 LOMONOSSOV continued (GLOEDE Group)

GLOEDE - Leader, Acoustic Torpedo Heads (KOMMANDOGERÄTE)

KLIMKE - Mathematician

GRAEFE - Physicist (crystal receivers)

HILDEBRANDT - Telecommunications

BOSE - Light current engineer (amplifiers)

SEDLER - (designer)

MARTIN - Light current engineer (torpedo pistols)

KIEBOKE - Physicist (Consultant)

DILL - Designer (amplifiers)

During this time no practical work was undertaken.

Reports were written on German practice and some instruments were made for high frequency measurement. A resonance amplifier was built. No real work could be done owing to the lack of materials. There was a marked lack of interest owing to the rumour that the Navy was giving up the Institute. GRAEFE and KIEBOKE worked empirically on LUT apparatus and apart from a few calculations they did nothing else. These two also produced a paper on the results of experiments on LUT apparatus and the strike probability of LUT torpedoes. This in spite of the fact that all the others knew nothing about the subject.

GLOEDE was mainly occupied together with HILDEBRANDT with drawing up reports on German equipment available.

GLOEDE was also occupied in collecting and redrafting reports of GEIER apparatus captured by the Russians, together with some German reports. All reports had to be accompanied by a detailed criticism suggesting methods of counter action and, further, ways and means of overcoming this counter action. The suggestions made were confined to rough outlines without exact details, but even these suggestions were apparently never followed up.

A model of the LERCHE apparatus was constructed on the basis of an actual LERCHE Head captured by the Russians. Amplifying and control equipment was added to this Head and a deputation from MOSCOW visited the Institute to see the model in operation. Commands were given over a wire of about 12 metres length. LERCHE and ZAUNKOENIG apparatus was available in the Institute for examination and was actually dismantled by members of the GLOEDE Group.

MARTIN was given the task of drawing up reports on magnetic torpedo pistols (MM apparatus) and of providing all the details he could of the acoustic pistols which were in course of development by Professor HERTZ of SIEMENS during the war.

7. LOMONOSSOV 1947 continued (KOLL Group)

1. KOLL - Leader light current engineer
2. MAECKBACH - Physicist
3. JOHN - Engineer
4. GRAF - Foreman electrician
5. PROMNITZ - designer

6. BACHMANN - Designer (components)

7. GRAEUELLER - Precision mechanic (electrical installation assembly)

8. LUERING, Helga - Draughtswoman

9. KAHLMANN, Elfriede - Draughtswoman

10. JASKA, Elisabeth - Typist

The first task allotted to the KOLL Group was the development of an acoustic mine sweeping system, frequency about 25 cycles; the Russians called this "BARABAN". The design was begun in SESTORETSK. Professor LUEBCKE was asked by KOLL to carry out certain calculations; he refused and KOLL then asked GRAEFE. Then LUEBCKE decided to do the work himself and the design was completed by PROMNITZ. It was found, however, that a slight error had occurred in LUEBCKE's calculation and this upset produced the only episode of punishment recorded. LUEBCKE was fined one-third of his salary for three months. GRAEFE rectified the mistake.

The apparatus consisted of a streamlined body containing a motor with gearing to allow two membranes to operate with a counter-action. This apparatus was to be designed for frequencies up to 100 cycles and the calculations were required to establish the permissible amplitude of the membrane avoiding cavitation After the discovery and correction of the error the idea was abandoned.

Components of a shaking table were received at the Institute from BERLIN, and MAECKBACH carried out calculations with this equipment which was assembled at the Institute and was used for calibrating the sound receivers and for other measuring purposes.

All the work described above was carried out at the express desire of the Russians.

8. LOMONOSSOV 1947 continued (LEUNA Group)

When the German specialists were transferred from SESTORETSK to LOMONOSSOV the LEUNA Germans stayed behind. They lived in SESTORETSK and worked at two different Institutes in LENINGRAD.

9. LOMONOSSOV 1948 - 1953 N.I.I. 400

In June 1948 the Institute came under the control of N.I.I. 400 and was considered a Branch (Filiale) of N.I.I. 400 HQ. in LENINGRAD. Until some time in 1951 the Branch was under the direction of a Russian by the name of GRUDNITZKI whose appearance is described as that of a tramp and whose knowledge was apparently not very extensive. The name of his successor is unknown. Visits were paid by various Russians from LENINGRAD including KUVIN, the Physicist. These visitors did not seem to have been very competent men and the apparent object of their visits was the allocation of orders.

[redacted] the main Institute was considered a fifth-rate affair and always seems to have been in financial difficulties. In December 1952 the electricity was cut off in LOMONOSSOV owing to non-payment of account. Orders placed by the Institute were not accompanied by a proper specification and the stipulations made were sometimes ridiculous. 25X1

In 1951 control of N.I.I. 400 was taken over from the unknown successor

of GRUDNITZKI by MAXIMOV. MAXIMOV was by reputa a heating and sanitary engineer. His knowledge of the work done in LOMONOSSOV was practically nil and he was never known to enquire about the progress of the tasks given to the Germans. It was the German impression that MAXIMOV like all the other Russians had been sent there out of the way.

When N.I.I. took over in June 1948 a part of the premises were allotted to a school for naval ratings. Curriculum unknown.

Note: The impression [redacted] 25X1
[redacted] is of a very happy-go-lucky Institute with little sense of direction 25X1
and less control. The premises were guarded by Russian women armed with rifles: when one of them was asked to fire her piece at a supposed intruder she had no rounds, nor would she have known what to do with them if she had. When MAXIMOV discovered that the Head of Department 3 (GLOEDE/KOLL) had been misleading him with regard to the progress of the tasks in hand, he appointed a successor. This successor turned out to be a psycopath but even he was only removed when the confusion became almost insurmountable. Again, in the grounds of the Castle was a museum, this museum in the former Chinese pagoda of the MENSCHIKOVS was open to the public and thus the whole grounds of the Castle were too.

10. LOMONOSSOV 1948 - 1953 continued (LAWITSCHKA Group)

The personnel of this group remain the same. The following tasks were undertaken:

(a) A concrete bunker for fuel testing. In charge MYSLIWETSCHECK

(b) Laboratory. No further information available. A chemical laboratory, this was operated only by the Russians. Names unknown. Although the laboratory was planned and possibly built by Germans, they were not allowed in on completion. LAWITSCHKA himself dealt with the Russians in this matter.

(c) Hydrogen-peroxide was used in the laboratory but its concentration is not known. [redacted] 25X1
[redacted] 25X1
Nothing is known of containers or of transport facilities. Explosions from the laboratory 150 yards away were heard [redacted] 25X1
[redacted] about half a dozen were 25X1
heard in eighteen months (1951 - 1952).

(d) Workshop. It had welding apparatus and one lathe larger than usual.

Neither MYSLIWETSCHECK nor LAWITSCHKA was really capable of developing a hydrogen peroxide engine. It was doubtful whether anyone in this Group could be trusted to think out anything new, nor was the Russian direction considered to be any more capable.

11. LOMONOSSOV 1948 - 1953 continued (GLOEDE Group)

Among the several Russian departmental managers for Department 3 was PRIKLSHIKOV a young energetic technical man who was, however, soon transferred to the Ministry. Another manager was MOSKOIENKO a man of no deep knowledge, but having a superficial acquaintance with many subjects. He was generally called the 'Bluffer'. [redacted] he was also a lecturer in a LENINGRAD 25X1
Institute, speciality Optics. There was another Russian working with them, name unknown.

When in June 1952 it was first announced that some of the German specialists would be returning home there was an intake of four young engineers, some of whom had not yet completed their training. They seemed to be of a higher standard of intelligence and they were believed to be replacements for the Germans. Just before the team left, about five mechanics and some female assistants were working with the GLOEDE Group.

The GLOEDE Group was given the task of building the Measuring Station and equipping it for actual sound pressure measurement (absolute Schalldruckmessungen). Professor LUEBCKE had been given the job of considering this during November 1947 and subsequent work done by the Group revolves round this subject.

It was found extremely difficult to make these absolute measurements although comparative measurement was easy. GRAEFE was asked to develop a crystal detector and some were developed which used tourmaline quartz and Rochelle salt, these were not successful. After this, interest went as there were no more funds available to carry on the investigation. Soon after the failure Professor ANDREYEV came from MOSCOW and showed an interest in the crystal receiver. [redacted] he had built such a receiver himself and experienced the same difficulties, namely that the impulse given off by the C.R. tube was distorted by the crystal receiver, much as if the impulse had been sent through an electric filter of the wrong dimensions.

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[redacted] description of the Testing Station see Annexure I.

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description of crystal receivers see Annexure II.

description of Sound Pressure measuring equipment for low frequencies, see Annexure III.

There was an instrument store for the Group under the charge of a Russian woman ANDREYEVA, she was technically incompetent but would not let Germans help her in storing, accounting or checking instruments. Towards the end the store was greatly enlarged but the Germans were not allowed to find out what was available for them. Instrument repairs were usually carried out by GRAHNUEHLER.

BOSE constructed an analyser of the usual form, but not very satisfactory. The design was drawn up by GLOEDE. This analyser was actually completed although after a very long delay, the analysis range was 10 - 100 kilocycles.

MARTIN assisted by GRAEFE and KIENKE constructed a sound pressure wave measuring device. This had three scales, 5 cycles to a few hundred cycles, then to 6 kilocycles, thence to 10 kilocycles.

GLOEDE made an acoustic spectrometer with 16 channels, 10 to 100 kilocycles. Selection was done by a magnetic switch but this later was to be altered to an electronic selector system. GLOEDE had no experience in this field but based his work on German and American publications.

12. KOLL GROUP.

This Group had little to do during the period [redacted]

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MAECKBACH constructed a Helmholtz coil for magnetic measurement in connection with the receiver parts of a magnetic mine.

KOLL also constructed an analyser and spectrometer for sound and frequency measurements, 5 cycles upwards. The calculations for this were drawn up by HEINZERLING.

PROMNITZ constructed a pen recorder for an oscillograph.

SCIENTIFIC ORDER OF BATTLE

(a) ESTABLISHMENTS

O.T.B.

The O.T.B. was in charge of the Institute at LOMONOSOV (formerly ORANIENBAUM) from 1947-48. Broadly the aims of O.T.B. were the reconstruction of underwater weapons. In particular one group of Germans was concerned with mines and mine-sweeping (KOLL Group). One group was concerned with the INGOLIN Torpedo Motor (LAWITSCHKA Group), the third and last group - Acoustic Control (GLOEDE Group).

1. N.I.I. 400

N.I.I. 400 is an Experimental Institute controlled by the Ministry of Shipbuilding. The Branch (Filiale) in LOMONOSOV is controlled by a H.Q. in LENINGRAD.

The German personnel were divided up as before and were pursuing the same tasks.

(b) PERSONALITIES (Section I)

Russians (Naval Officers) in O.T.B.:

(i) Admiral BORCHANOV - [redacted] 25X1
[redacted] 25X1

(ii) Captain First-Class SERBIN [redacted] 25X1
[redacted] 25X1

(iii) Engineer TERASSOV - Worked during 1947 with LAWITSCHKA Group.

(iv) Major GUSYOV - In charge of GLOEDE/KOLL Groups. [redacted] 25X1
[redacted] 25X1

2. RUSSIANS ASSOCIATED WITH N.I.I. 400

(i) GRUDNITSKI [redacted] 25X1
[redacted] 25X1

(ii) MAXIMOV - Head of the Institute after GRUDNITSKI. [redacted] there was another Russian [redacted] 25X1
who came in between GRUDNITSKI and MAXIMOV. MAXIMOV was by repute a heating and sanitary engineer. [redacted] 25X1
[redacted] 25X1

(iii) PRIKASHIKOV [redacted] 25X1

[redacted] 25X1

(iv) MOSKOLENKO [redacted] 25X1

[redacted] 25X1

(v) Professor ANDREYEV [redacted] 25X1

[redacted] 25X1

(vi) ANDREYEVA - a Russian woman in charge of the Instruments Store. [redacted] 25X1

3. GERMAN PERSONALITIES

(a) LAVITSCHKA Group

(i) Kurt LAVITSCHKA - the leader of his Group, he was the only man who had direct dealings with the Russians;

(ii) MYSLIWETSCHECK - in charge of engine tests. MYSLIWETSCHECK is a mechanical engineer who studied heat engines in PRAGUE. [redacted] 25X1

(iii) ABERMETH - designer - probably the most important man in the Group.

(iv) Von LOEWIS - job not known.

(v) SIMMEL - job not known.

(vi) KEMPA - designer.

(vii) Ursula DUERING - draughtswoman.

(viii) Anita SIMMEL - draughtswoman.

(ix) MAGERSTEDT - no particular job.

(x) SCHOLZ - fuel tests.

(b) GERMANS FROM LEUNA (GLOEDE Group)

(i) GLOEDE - Leader. His speciality is kommandogeräte.

(ii) KLEMKE - A mathematician.

(iii) Dipl. Ing. Gerhard GRAEFE - a Physicist. He worked on crystal receivers.

(iv) HILDEBRANDT - a telecommunications engineer. [redacted] 25X1

[redacted] 25X1

(v) BOESE - a light current engineer. Was employed on the development of amplifiers.

(vi) Gerhard SEDLER - designer [redacted] 25X1

(vii) MARTIN - a light current engineer formerly with SIEMENS; during the war with the O.K.M.: his speciality is torpedo pistols.

(viii) Professor Ernst LUEBCKE - physicist.

(ix) DILL - designer. [redacted] 25X1 25X1

(c) KOLL Group

(i) Roman KOLL - Leader - a light current engineer.

(ii) MATCKBACH - Physicist.

(iii) Kurt JOHN - engineer.

(iv) GRAF - foreman electrician.

(v) PROMITZ - designer - considered very good.

(vi) GRAHMUELLER - precision mechanic - specialised in assembly of electrical installations.

(vii) Holga DUERING - draughtswoman.

(viii) Elfrieda KAHMANN - draughtswoman.

(ix) Elizabeth JASCHKE - typist.

4. GERMANS FROM LEUNA

(i) Dr. KAUFMANN - Leader.

(ii) Dr. VIZHORMIRSKY - a specialist in plastics and resins. [redacted] 25X1 25X1

(iii) Dr. GEISELER

(iv) Dr. ECKHOLDT

(v) Dr. PEINZE

(vi) Dr. POHL

(vii) Dipl. Ing. OTTO - Chief designer in LEUNA after the war.

(viii) Dipl. Ing. SCHOLZ - he later was attached to the LAVITSCHKA Group (see above).

(ix) LORENZ - foreman.

(x) FRIESE - foreman.

Annexure 1 [redacted]

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TESTING STATION WITH TANK FOR RECIPROCAL CALIBRATION

1. Transmitter Instruments

(a) Mains supplying unit

(b) Generator 10/100 kc/s.

(c) Pulse generator; variable pulse duration 0.2 ms. to 10 ms. Keying frequency adjustable. The ratio between pulse spacing and pulse duration may be changed within the limits of 1 and 20.

(d) High tension stage with tunable oscillatory circuit, giving about 2 kV output. The crystal transmitter capacity lay within this range.

(e) Potential divider supplying the test voltage for

(f) Oscillograph required for the setting of the pulse form and the control of output.

2. Receiving Equipment

(a) Input amplifier, two-stage. Amplification 10 times.

(b) Wideband amplifier. Amplification more than 10^5.

(c) Two-stage resonance amplifier with variable damping.

(d) Oscillograph or valve voltmeter as measuring instrument for receiver voltage.

(e) Potential divider 1 : 1000.

(f) Valve voltmeter to be used with the potential divider for calibrating the receiver.

3. Operation

The tank was 6 m. long and 3 m. wide and 4 m. deep. The water could be illuminated so that the instruments were clearly visible when submerged. The two rotating stands for holding and directing the transducers could be freely rotated in the horizontal plane and had a 360° scale with a vernier. They were mounted on plates which could be moved along rails running the length of the tank.

A round quartz plate, thickness 24 mm. diameter 60 mm. radiating from one side acted as a transmitter. It was fastened in the oscillation node with a rubber gasket backed by a bronze cap. ADP (Amoniumdiphosphat) was used for a second transmitter. Two crystals, dimensions, 10 x 10 x 20 mm.: radiation surface 20 x 20 mm.: electrode surface 10 x 20 mm., connected in parallel were enclosed in plexiglas casing and radiated in quadrature as a double membrane. Two similar crystals were used for the construction of the reciprocal auxiliary transducer which is used in calibration as a transmitter or as a receiver. There was to be a metal casing. The crystals were to be pressed against a membrane and sealed at the back with an air cushion. [redacted]

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The sensitivity of the transducer was such that at a distance of 150 cm from the sound source, at a transmission voltage of 2 kV, there was an acoustic pressure of 200 bar. For quantitive measurements, both the transmitter and the receiver were fed through a magnetic voltage regulator as the mains (voltage) fluctuated too much.

For the calibration of the receiver a generator voltage was supplied to the initial amplifier or the wide band amplifier through a potential divider. By switching in a delay circuit between the generator of the transmitter and the broad band amplifier of the receiver, it was possible to block one of the amplifier stages. This system suppressed echoes. The keying pulse unlocked the receiver amplifier after a delay of 1 ms. by the delay circuit. The smallest reflection path in the tank was not much longer than 3 ms, the speed of sound in water being 1500 m/s. This is equal to a transit period of 2 ms. The measuring distance (that is between transmitter and receiver) being 150 cm, and the pulse duration 1 ms., the direct pulse passed the receiver just before the first echo which then came up against a reblocked amplifier. 25X1

The suitability of the tank for measurements was tested by a magneto-striction oscillator made of captured material. [redacted] 25X1

The radiation surface was 9 x 10 cm. The measuring frequency at about 50, 80 and 100 kc/s was determined from the first three zero points of the directional curve. The results were satisfactory. The three values did not vary more than 2.5 per cent at 50 kc/s.

Annexure 2 [redacted] 25X1

Page No. 1.

Crystal Receivers for the frequency range 10 - 100 kc/s

The technical requirements were:

Lower measuring limit 1 bar.

The receivers to be omnidirectional (ungerichtet) in the horizontal plane.

The apparatus was to be used on board for measurements in open water. At first the depth mentioned was 10 m., later 30 m. The amplifier to go in the water was designed accordingly.

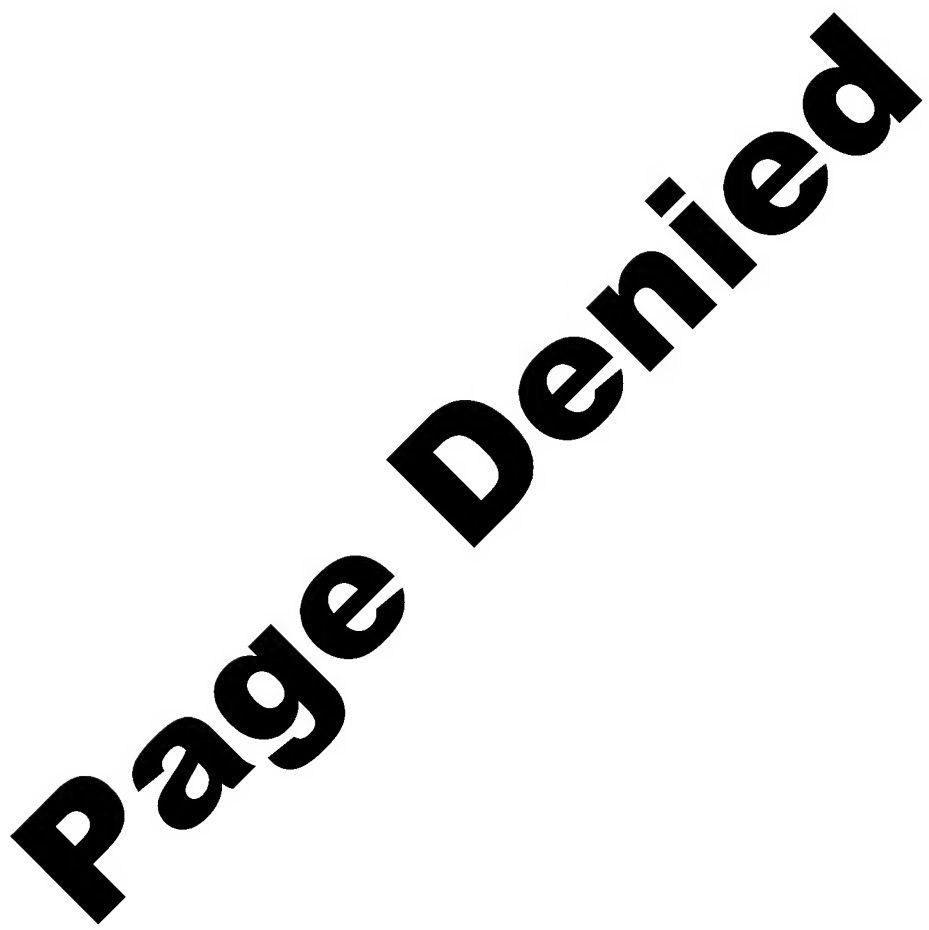
[redacted] 25X1

The volume effect of tourmaline and the theoretically as yet unexplained volume effect of quartz were used for the design of uncased receivers. Further, a Rochelle salt receiver in a metal casing was constructed. Tests with the receivers produced incomprehensible directional effects combined with severe distortion of the pulse form, even with the quartz receiver, although this receiver showed rotation symmetry horizontally. Further variants, for which, apart from quartz and tourmaline, ADP (diphosphate of ammonia) was also used, behaved fundamentally in the same way.

[redacted] 25X1

It was found that the test station was in a hopeless state. All apparatus had to be overhauled, after several female "engineers" from the NII 400 in LENINGRAD had measured with it. Some items were missing, and the workshop had to make them anew in a hurry it was quite unaccustomed to. At last construction of the reciprocal auxiliary transducer was commenced, the design of which had been ready for a long time. All the same, new ADP-crystals had to be procured, as those which had been available were not to be found. About November the material for the cylinder-shaped barium-titanate receiver [redacted] was also procured. 25X1
No definite technical data could be obtained from the manufacturers. The samples were delivered in a processed state in the size prescribed in the design. They were cylinders 5, 8 and 10 mm. in diameter and 10 - 15 mm. in length. Measurements of the co-efficient of penetration according to polarisation with 12 - 15 kV/cm. produced values which corresponded to a sufficient extent to those indicated in literature on the subject. It transpired, however, that many samples had fine cracks invisible to the naked eye, which betrayed themselves by discharges during polarisation.

Tests with the satisfactory samples (dia. 5 and 8 mm.) in the tank showed that mechanically they worked satisfactorily. The directional effects were within the limits stated in the literature. These findings caused the departmental manager, MOSKOLENKO, and the laboratory manager, ORLOV, to go absolutely wild with delight. The matter must therefore have been very urgent. Apparently, the NII 400 in LENINGRAD, would no longer be put off with excuses and wanted at last to have the apparatus, which had been reported as completed years before. The director of the branch, MAXIMOV, also appeared frequently in the laboratory and showed an interest,



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Annexure 3

[redacted]

Sound Pressure Measuring Equipment for Low Frequencies

The technical requirements for the apparatus were:

Frequency range: 5 cycles - 10000 cycles

Amplitude range: 1 bar - 3.10^5 bar.

Sealing for 200m depth of water.

Receiver horizontally omnidirectional (ungerichtet)

Entire apparatus without drift (Frequenzgang) in the measuring range, in order that the indicating apparatus may be calibrated direct in bar.

After the first model had been completed, a further 4 or 5 sets of apparatus were ordered. [redacted] For some apparatuses official calibration certificates were already to hand from a LENINGRAD Institute.

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Each apparatus consists of 3 crystal receivers of different sizes, 3 preliminary amplifiers and a measuring amplifier.

The receivers are equipped with a set of 6 ADP crystals (di-phosphate of ammonia) in parallel. The metal casing is drum-shaped. The crystal unit lies between 2 firm membranes, which are separated by rubber packing from the cylinder casing and are held in place by screw caps. The receivers thus represent acoustically 2 membranes in quadratures. For those parts of the equipment which are under water, the receivers and preliminary amplifiers, bronze capable of withstanding seawater was specified. The first receivers and pre-amplifiers were also made of this material. Later on, it could no longer be procured, and therefore brass and duralumin were used. Some amplifier housings of brass were not watertight and were tinned inside and out. Of the following data, only the size of crystals for receiver I is exact. The other figures are approximate.

Receiver I: 5 c/s - 1500 c/s
6 ADP crystals 10 x 50 x 60 mm.
Radiation surface, 60 x 60, electrode surface 50 x 60
Membrane thickness 5 mm.
Diameter of the metal casing 90 mm.

Receiver II: 1500 c/s - 5000 c/s
Diameter 70 mm.

Receiver III: 5000 c/s - 10000 c/s
Diameter 50 mm.

The receivers were originally joined to the pre-amplifier by means of metal tubes. This, however, gave rise to imposed frequencies. The tubes and the amplifier housing were highly resonant, and the tubes were therefore replaced by rubber cables. The length of these cables depends on the frequency range concerned. A body whose size is comparable with the wavelength considerably disturbs the field of

sound, unless it is at least one wavelength away from the receiver. Therefore, the cable length for Receiver II is about 70 cm and for Receiver III about 100 cm. Receiver I has a very short cable. With 1.5 kc/s the pre-amplifier may already be regarded as small compared with the wavelength.

The pre-amplifiers are cylindrical in shape and are available in two designs, which differ in height. The diameter is about 15 cm, height 25 cm and 15 cm.

The shorter design is the later one. [redacted] 25X1
25X1
It is probable that it was possible to save space by a simplified construction. The pre-amplifier is connected to the measuring amplifier by a multi-strand rubber cable. The length of the cable is 200m.

The amplitude range is divided into 2 ranges of equal size, i.e. $1 - \sqrt{3}.10^5$ bar and $\sqrt{3}.10^5$ bar - 3.10^5 bar. A relay can be operated by the main (measuring) amplifier via the cable in the pre-amplifier; this relay switches a condenser in parallel with the crystal. This reduces the sensitivity by the factor $\sqrt{3}.10^5$. The indicating apparatus belonging to the measuring amplifier, a moving coil instrument, also has 3 sensitivity ranges.